(12) UK Patent Application (19) GB (11) 2 166 822 A

(43) Application published 14 May 1986

(21) Application No 8526396

(22) Date of filing 25 Oct 1985

(30) Priority data
(31) 8431730 (32) 29 Oct 1984 (33) DE

(71) Applicant
Lucas Industries public limited company (United Kingdom),
Great King Street, Birmingham 19, West Midlands

(72) Inventors
Hans-Georg Madzgalla
Rainer-Lorenz Duing
Heinz-Willi Baum

(74) Agent and/or Address for Service
W P Thompson & Co,
Coppers Building, Chruch Street, Liverpool L1 3AB

(51) INT CL[4]
F16D 65/02

(52) Domestic classification
F2E 104 114 1A1B 1A2E 1A2F 2N1C2C 2N1C3 2N1D16 2N1E5 2N1K1 EE HB LDA
F2S 504 511 CA
U1S 2013 F2E F2S

(56) Documents cited
GB 0854813

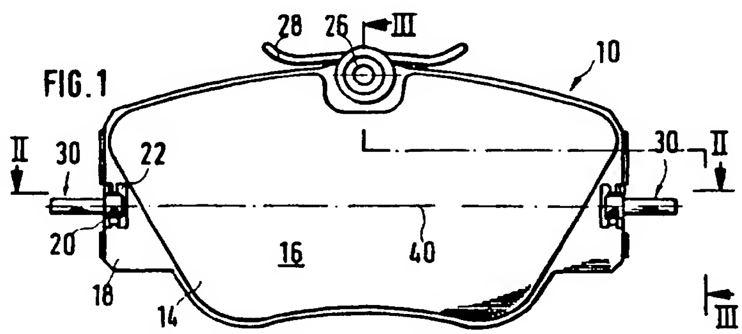
(58) Field of search
F2E
Selected US specifications from IPC sub-class F16D

(54) A brake pad for dic brakes

(57) The pad 10 has at least one return spring 30 with a mounting portion 32 supported on backplate 12. Each return spring 30 is made of a plastically deformable material having residual elasticity (e.g. sheet steel) and includes a coil 36, part of which coil provides a supporting portion 44 which serves as a support when engaged with a stationary brake member 46. Plastic deformation maintain substantially constant brake clearane. As shown mounting portion 32 is hook-shaped and extends through lateral recess 20 is backplate 12 to engage in recess 22; an arm 34 is supported on a vibration damping layer 24. Supporting portion 44 is shown provided by outside surface of coil; the coil is an Archimedean spiral and unwinds during the plastic deformation.

Other embodiments are disclosed e.g. the mounting portion may be fastened to the backplate together with a supporting portion (50, Figs. 9, 10).

FIG.1



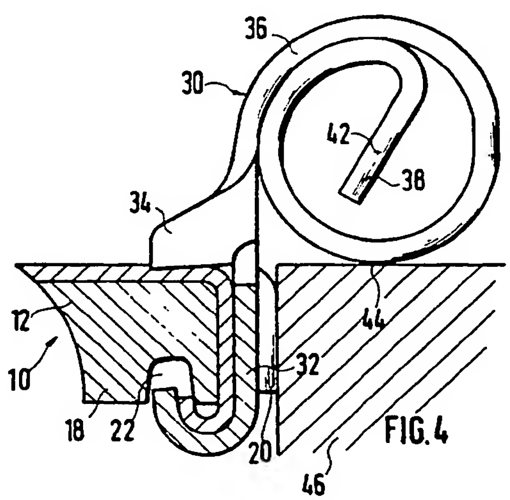


FIG.4

GB 2 166 822 A

FIG. 1

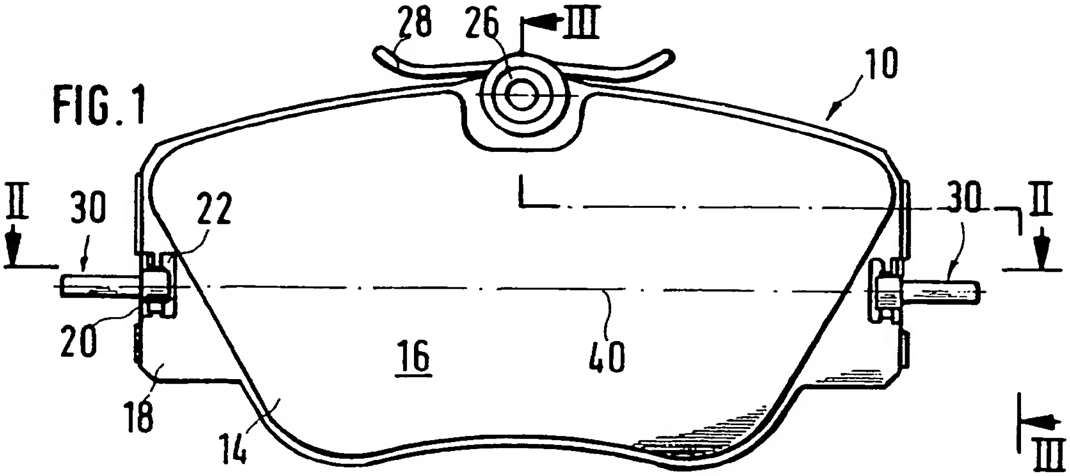
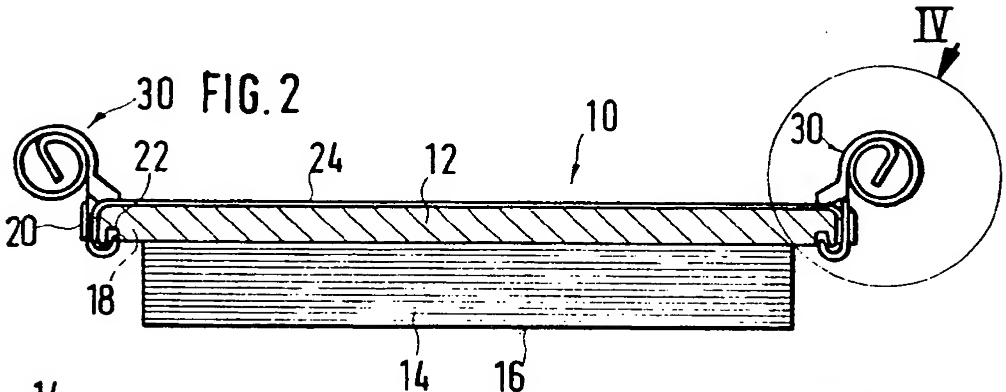


FIG. 2



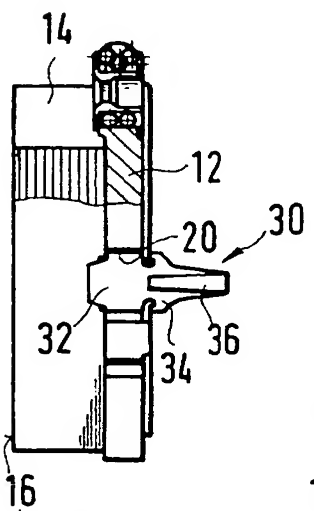


FIG. 3

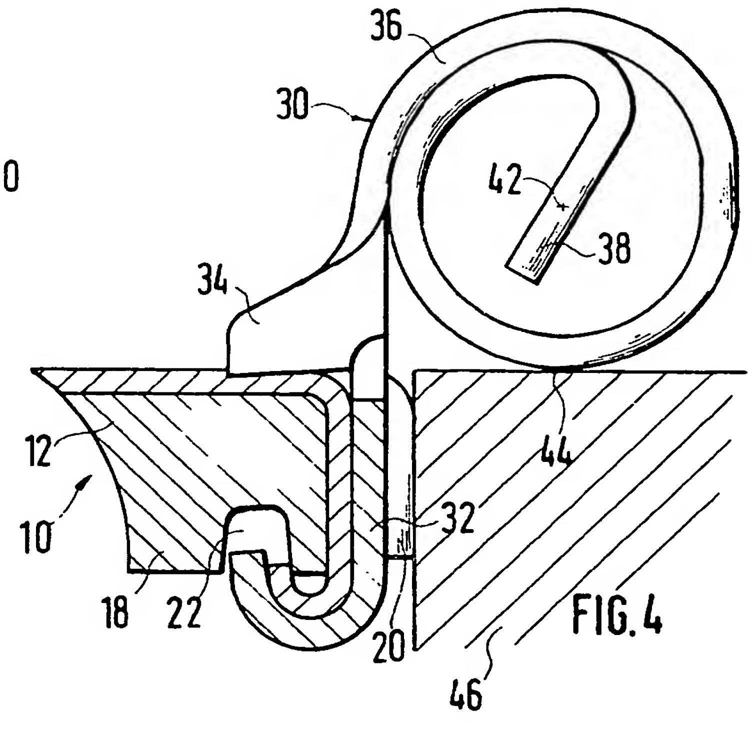


FIG. 4

FIG. 5

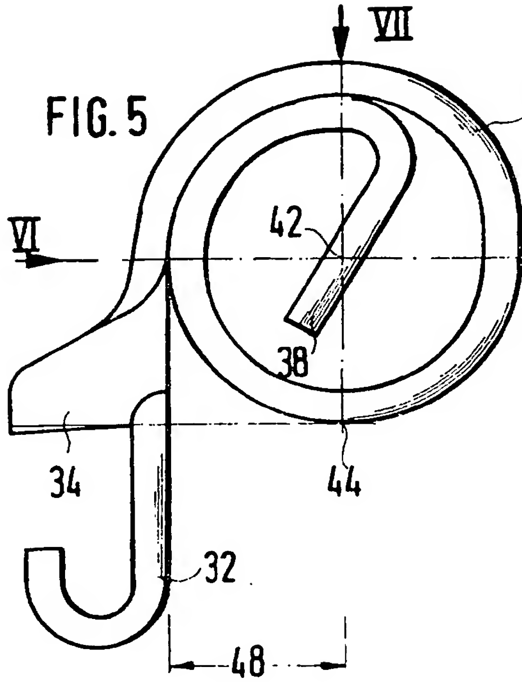


FIG.6

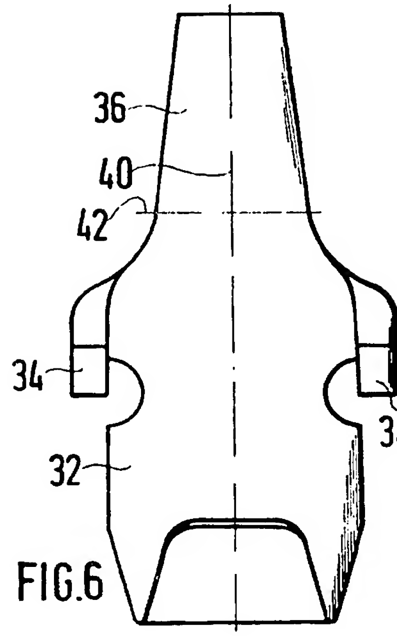


FIG.8

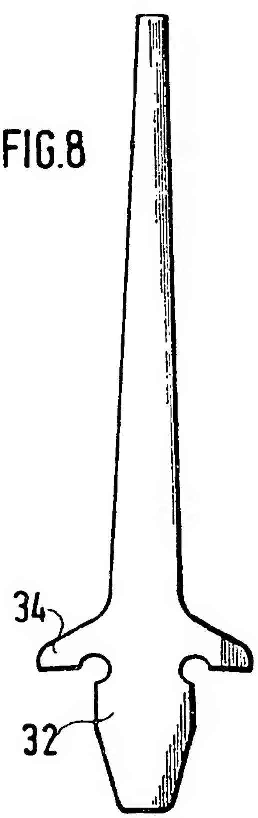


FIG.9

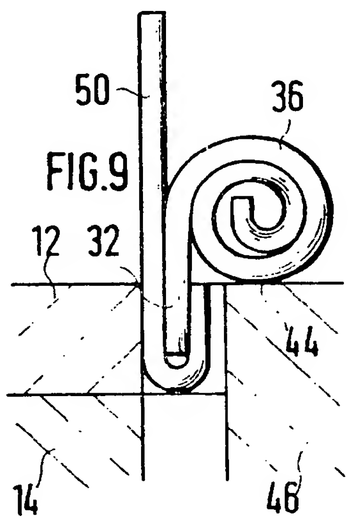


FIG.10

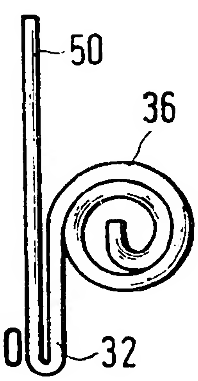
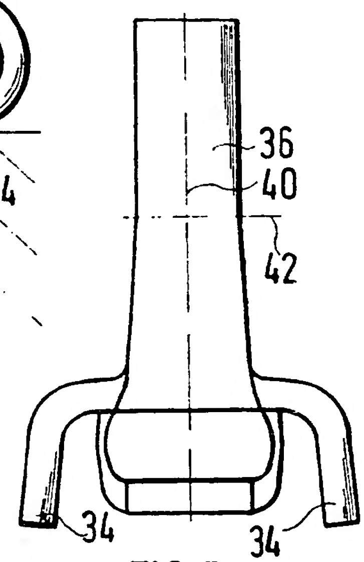


FIG.7



SPECIFICATION

A brake pad for disc brakes

The present invention relates to a brake pad for use in a disc brake.

In particular the present invention relates to a brake pad comprising at least one return spring which is made from a plastically deformable material having a residual elasticity, which is secured to the brake pad by a mounting portion formed at the return spring, extends from that portion rearwardly and away from the braking surface of the brake pad, and includes a coil as well as a supporting portion designed for support on a stationary brake member.

In a known brake pad of this kind (US–A–4 364 455) comprising a backplate whose side edge regions are free of friction lining, a return spring made of round wire is attached to each of these two edge regions. Each of the return springs has a straight fixing portion which passes through an aperture in the corresponding margin of the backplate and has a head at the front side thereof by means of which the return spring exerts a rearwardly directed return force on the brake pad. Behind the straight fixing portion at the rear of the backplate the return spring forms a coil in the form of a cylindrical helix. This is followed by a substantially straight leg extending in the circumferential direction of the corresponding brake pad and being supported on a stationary brake carrier. When the brake pad is substantially new so that its friction lining has approximately the original thickness, the legs of both return springs are so inclined with respect to the brake carrier that they each contact the latter by a small supporting area only which is spaced a great distance from the coil and located close to the slightly bent end of the leg. As the wear of the friction lining continues, the leg gradually abuts the brake carrier along a greater part of its length, whereby the distance of the supporting area from the coil becomes ever smaller. As a result, the spring characteristic of both return springs becomes steeper so that the return springs exert greater return forces on the brake pad when lining wear has progressed, as compared with the use of an un-worn friction lining. Regardless of the state of wear of the friction lining, difficulties are encountered with the known design of the return spring because of the fact that their mounting portion fixed to the brake pad is axially spaced, with respect to the coil, from the leg which is supported on the brake carrier and this has the consequence that the return springs exert moments which tend to tilt the brake pad about an axis which is tangential to the braking surface.

It is, therefore, an aim of the present invention to develop a brake pad of the kind described initially such that disturbing moments and variations of the return forces are avoided or at least limited to an extent which does not bother.

According to the present invention there is provided a brake pad for a disc brake, comprising at least one return spring which is secured to the pad by a mounting portion of the spring, the spring being made of a plastically deformable material which has a residual elasticity, the remainder of the spring extending from the said mounting portion rearwardly of the brake pad and including a coil, part of which coil forms a brake pad support portion for supporting the pad on a stationary brake member.

Thus, with the present invention, the said supporting portion is formed by the coil itself. As a result the lining continues to wear, the coil rolls off the stationary brake member and does not change its position or diameter while doing that, or does so only slightly. For this reason it is advantageous that the or each return spring in accordance with the invention is supported directly by its coil on the stationary brake member.

The supporting portion preferably is formed by the at least approximately cylindrical outside surface of the coil. However, it is possible as well for the coil to be supported by its inside on a stationary brake member, such as by a pin which passes through the coil or at least projects into the same.

If a pair of return springs are provided, each secured to a lateral edge region of the brake pad, then the return springs according to the invention, contrary to the known arrangement described hereabove, preferably are wound away from each other, starting from their respective mounting portion fixed to the brake pad so that their coils project laterally outwardly beyond the corresponding lateral edge of the brake pad. This design and arrangement of the return springs is especially well suited for supporting them on a brake carrier in close vicinity to a lining shaft in which the brake pad is guided.

It is especially advantageous for the mounting portion and the supporting portion of the or each return spring to have a common plane of symmetry normal to the axis of the coil. In the case of a return spring made of round wire the symmetry may be realized for instance by dividing the coil into two helical coil sections which are interconnected by a common mounting portion secured to the brake pad and, for example, of hairpin shape.

However, the desirable symmetry of the overall return spring is achieved in a particularly simple manner in accordance with a further development of the present invention by making the coil an Archimedean spiral. In this case the return spring preferably consists of sheet metal and it is further convenient to have the width of the return spring diminish

steadily along the length constituting the coil and toward the inner end thereof. By virtue of this reduction of the spring width the influence of the coil diameter is varied so that it becomes slightly less as the lining wear progresses, and thus the elastic force is kept substantially constant.

If the brake pad in per se known manner comprises a backplate which has lateral edge regions free of brake lining, then the mounting portion of the or each return spring fixed to the brake pad preferably is bent like a hook and engages across the corresponding side edge of the backplate into a recess formed in the front face of the backplate. Between this mounting portion and the coil, the return spring preferably includes a pair of arms which are supported on the rear of the backplate.

The last mentioned embodiment of the present invention may be developed further for a brake pad having a per se known vibration damping layer at the rear of the backplate, by the vibration damping layer being extended across the lateral edge regions to which the return spring is fixed, and into the corresponding recesses as in the front face of the backplate, the hook-shaped mounting portion as well as the two arms of each return spring being supported exclusively by the vibration damping layer on the backplate. The result thus obtained is that the layer in question also dampens any vibration of the return springs.

If the coil is an Archimedean spiral, a particularly accurately reproducible roll-off behaviour may be obtained according to another feature of this present invention, by a supporting sheet being secured to the brake pad in abutment with the end portion of the return spring, and extending rearwardly beyond the coil.

The present invention will now be further described, by way of example, with reference to the accompanying drawings, in which:

Figure 1 is an elevational view of a brake pad according to the invention including a pair of return springs;

Figure 2 is the section II–II in Fig. 1;

Figure 3 is the section III–III in Fig. 1;

Figure 4 is the cut-out IV of Fig. 2, with a return spring, greatly enlarged;

Figure 5 is a view corresponding to Fig. 4 of the return spring alone;

Figure 6 is the view of the return spring in the direction of arrow VI in Fig. 5;

Figure 7 is the view of the return spring in the direction of arrow VII in Fig. 5;

Figure 8 is the development of the return spring at reduced scale as compared to Figs. 5 to 7;

Figure 9 is a presentation corresponding to Figs. 4 and 5 of a modified return spring; and

Figure 10 is a variant of Fig. 9.

Figs 1 to 4 show a brake pad 10 which comprises a steel backplate 12 and a friction lining 14 having a braking surface 16 which faces the onlooker of Fig. 1. Two parallel lateral edge regions 18 of the backplate 12 are left free of friction lining 14. They each have a rectangular lateral recess 20 next to which and parallel to the corresponding side edge, another rectangular recess 22 is formed in the front face of the backplate 12. The rear of the backplate 12 is covered by a vibration damping layer 24 which, for example, consists of a thin sheet attached by bonding and/or coated with a plastics material. As may be seen especially from Fig. 4, the sheet of plastics material 24 is curved into the two lateral recesses 20 and extends into the adjacent recesses 22.

In the central upper area of the backplate 12, which is likewise left free of friction lining 14, a hollow rivet 26 secures a hold-down spring 28 in such a manner that it is pivotable within certain limits about the axis of the hollow rivet 26, said rivet axis extending normally with respect to the braking surface 16.

A return spring 30 is fastened to the backplate 12 in the region of each of the two lateral recesses 20. Each of these two return springs 30 is punched from sheet steel which, in flat condition, has the configuration shown in Fig. 8 which is similar to a sword. The end of the punched blank corresponding to the handle of the sword forms a hook-shaped mounting portion 32 in the finished return spring 30. In the area of the punched blank corresponding to the hilt of the sword the mounting portion 32 is followed by two arms 34 which are bent at right angles in the finished return spring 30 so that the return spring in this area has a U-shaped cross section. The entire remainder of the punched blank corresponding to the blade of the sword has a steadily diminishing width, starting from the arms 34. In the finished return spring 30 the blade portion forms a coil of the type of an Archimedean spiral, the inner end portion 38 of which is straight for reasons of manufacturing technique. The overall return spring 30 is symmetrical with respect to a plane of symmetry 40 extending at right angles to the axis 42 of the coil 36.

The two return springs 30 are each fastened like clamps to a respective lateral edge region 18, such that both arms 34 are supported at the rear of the backplate 12 on the vibration damping layer 24 into which they penetrate slightly. The hook-shaped mounting portion 32, on the other hand, also abutting the vibration damping layer 24 extends through the lateral recess 20 to the front of the backplate 12 where it engages in the adjacent recess 22. The return springs 30 are sufficiently elastic to permit the fastening described above by snap action without any plastic deformation worth mentioning of the mounting portion 32.

The substantially cylindrical outside surface of the coil 36 has a supporting portion 44 by

means of which the respective return spring 30, is in use, supported on a stationary brake member 46, particularly a brake carrier. Irrespective of the friction lining wear, only a small area of the supporting portion 44 is effective, this being almost line-shaped and parallel to the axis 42. The spacing 48 of this supporting portion 44 from the lateral edge region 18 of the brake pad 100 is almost constant.

When the brake pad 10 is pressed against a brake disc (not shown) for instance by an hydraulic piston or a floating caliper, normally the return springs 30 become deformed purely elastically so that they will return the brake disc, after actuation, at least approximately into its original position. However, if the wear of the friction lining 14 has advanced so that a corresponding greater clearance must be overcome to apply the brake, the return springs 30 become deformed also plastically. Consequently the brake pad 10 upon actuation will be pulled back by the return springs 30 only by a distance corresponding to the residual elasticity of the springs. In this manner substantially constant brake release clearance is maintained, regardless of the degree of wear of the friction lining 14.

The spacing 48 determines the lever arm of the force exerted by the brake pad 10 upon each actuation of the brake on each return spring 30. As the coil spring 36 of each return spring 30 unwinds with the advancing wear of the friction lining 14, the coil diameter is reduced slightly. The corresponding trend of the coil 36 of increasingly resist this unwinding is compensated by the fact that the sheet width of the coil 36 diminishes steadily toward the end portion 38 thereof.

The embodiment shown in Fig. 9 differs from the embodiment according to Figs. 1 to 7 essentially in that the mounting portion 32 of the return spring 30 shown is totally straight and fastened to the backplate 12 of the brake pad 10 together with a supporting sheet 50 by spot welding or caulking within the corresponding lateral recess 20. The supporting sheet 50 extends at right angles to the plane of the backplate 12 in a rearward direction and supports that part of the coil 36 which is unwound as the wear of the friction lining 14 progresses. In this manner an especially accurately defined and thus reproducible wind-off behaviour of the return spring 30, is obtained.

The variant according to Fig. 10 differs from the embodiment shown in Fig. 9 only in that the supporting sheet 50 is a rearwardly bent part of the return spring 30 itself, thus providing greater ease of manufacture.

CLAIMS

1. A brake pad for a disc brake, comprising at least one return spring which is secured to the pad by a mounting portion of the spring, the spring being made of a plastically deformable material which has a residual elasticity, the remainder of the spring extending from the said mounting portion rearwardly of the brake pad and including a coil, part of which coil forms a brake pad support portion for supporting the pad on a stationary brake member.

2. A brake pad as claimed in claim 1, in which the supporting portion is formed by the outside surface of the coil.

3. A brake pad as claimed in claim 2, comprising a pair of return springs each secured to a lateral edge region of the brake pad, the return springs being wound away from each other, starting from their mounting portions such that their coils project laterally outwardly beyond the corresponding lateral edge regions of the brake pad.

4. A brake pad as claimed in claim 3, in which the mounting portion and the supporting portion of the or each return spring have a common plane of symmetry normal to the axis of the coil.

5. A brake pad as claimed in claim 4, in which the coil is an Archimedean spiral.

6. A brake pad as claimed in claim 5, in which the or each return spring is made of sheet metal.

7. A brake pad as claimed in claim 6, in which the width of the or each return spring is reduced steadily along the length constituting the coil and toward the inner end portion thereof.

8. A brake pad as claimed in any one of claims 1 to 7, comprising a backplate having lateral edge regions which are free of friction lining, the mounting portion of the or each return spring being bent like a hook and engaging across the corresponding lateral edge regions of the backplate into a recess formed in the front face of the backplate, the return spring having a pair of arms between said mounting portion and the coil, the arms being supported on the rear of the backplate.

9. A brake pad as claimed in claim 8, in which a vibration damping layer is provided on the rear of the backplate, the vibration damping layer extending across the lateral edge region to which the return spring is fixed, to the corresponding recesses in the front of the backplate, the hook-shaped mounting portion as well as the two arms of each return spring being supported exclusively on the vibration damping layer.

10. A brake pad as claimed in any of claim 5 to 7, in which a supporting sheet is secured to the mounting portion of the return spring and extends rearwardly beyond the beginning of the coil.

11. A brake pad for a disc brake, constructed and arranged substantially as hereinbefore described, with reference to and as illustrated in the accompanying drawings.

Printed in the United Kingdom for
Her Majesty's Stationery Office, Dd 8818935, 1986, 4235.
Published at The Patent Office, 25 Southampton Buildings,
London, WC2A 1AY, from which copies may be obtained.